MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

TMA1201 – DISCRETE STRUCTURES AND PROBABILITY
(TC01 / TC02 / TT01 / TT02 / TT03 / TT04)

11 MARCH 2016
9.00 a.m - 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of **6** pages (inclusive of the cover page).

2. Answer **ALL** questions. The distribution of marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

4. Please write the answers for each question on a new page.

5. **NO CALCULATORS** are allowed in this exam.

QUESTION 1: SET, RELATION, FUNCTION, LOGIC   (Total Marks: 10)

(a) A relation R is defined on the set of integer, Z where

$$R = \{(x, y) \mid x + y \geq 2\}$$

   (i)   Is R a partial order? Justify your answer.

   (ii) Is R a function? Justify your answer.

                                        (2 + 2 = 4 marks)

(b) Given the predicate,

$$Q(x, y): xy = 1 \qquad \text{where} \qquad x \in Z \text{ and } y \in Z$$

Determine the truth values of the following statements. Explain each of your answer.

   (i) $\exists x \, Q(1, y)$

   (ii) $\forall x \exists y \, Q(x, y)$

   (iii) $\exists x \forall y \, Q(x, y)$

                                        (2 + 2 + 2 = 6 marks)

QUESTION 2: RECURSION, INDUCTION, ALGORITHM   (Total Marks: 10)

(a) Given the following mathematical statement:

$$3n \geq (1 + 2n) \qquad n \geq 1$$

    (i) Show that the inductive base is true.

    (ii) State the inductive hypothesis.

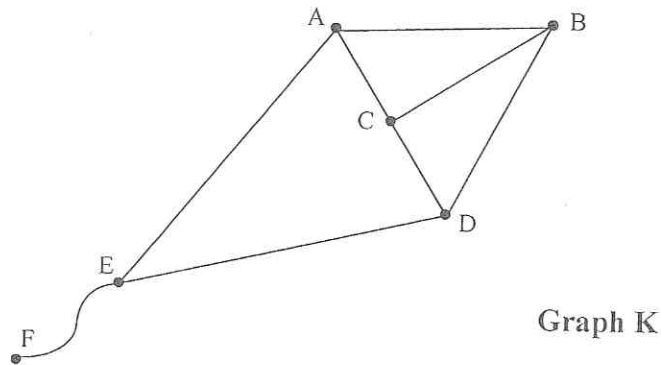   (iii) Show that the inductive step is true. $(2 + 1 + 4 = 7$ marks)

(b) Show that the average case complexity for $f(n) = 2n^2 + n$ is $\Theta(n^2)$.   (3 marks)

Continued ....

QUESTION 3: GRAPH THEORY   (Total Marks: 10)

Given the following Graph K,

Graph K

(a) Does Graph K have an Euler Circuit and/or an Euler Trail. Explain your reasons by referring to the Euler's Theorem.

(4 marks)

(b) With vertex A as the root, use the Breadth-First Search (BFS) algorithm to create a spanning tree for Graph K. Note that alphabetical ordering applies.
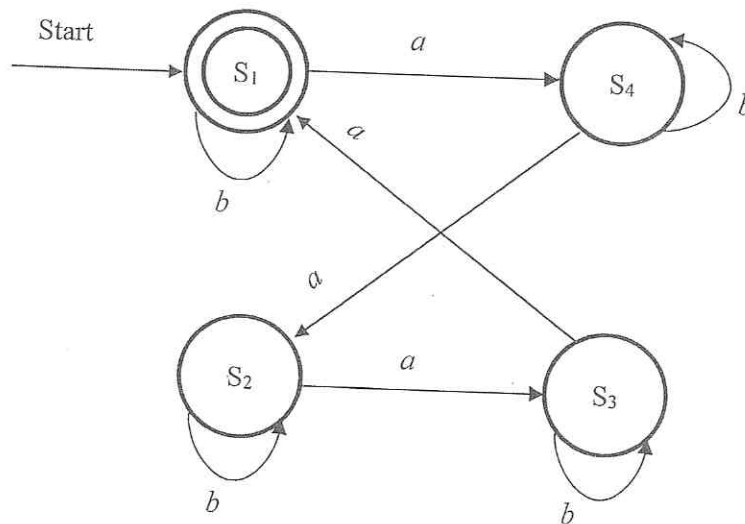
Use the table format as below:

Iteration	Queue	Edges

(6 marks)

Continued .....

QUESTION 4: FINITE-STATE AUTOMATA

(Total Marks: 10)

Given the following state transition diagram for a finite-state automaton, A:

(a) Create the state transition table for automaton A.

(b) Will automaton A accept the following input strings?

Input Strings	Decision
$a\,a\,a\,a\,a\,a$	
$b\,b\,b\,b$	
$a\,b$	

(c) State the language for automaton A.

$(5 + 3 + 2 = 10$ marks)

Continued .....

QUESTION 5: COMBINATORICS, PROBABILITY   (Total Marks: 10)

(a) Find how many different 6-digits numbers that can be created from the digits below:

| 3 | 3 | 4 | 5 | 5 | 5 |

(2 marks)

(b) Given the following table containing the probability density function (pdf) that describes the revision hours for a group of students in a day at a university:

Duration (Hours) x	0	1	2	3	4	5
$P(x)$	a	a	0.28	0.22	0.20	a

(i)   Find the value of a.

(ii)   Find the expected value, $E[X]$ and $E[2X - 4]$ for the pdf.

(iii) Given that when students studying more than 4 hours a day is a success, find the probability that in a sample of 10 students, exactly 9 students are doing revision more than 4 hours in a day.

(2 + 4 + 2 = 8 marks)

End of Questions.

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